

Fear of Neighborhood Violence During Adolescence Predicts Development of Obesity a Decade Later: Gender Differences Among African Americans

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Abstract

Background: African American youth are more likely than other racial and ethnic groups to be obese. African American youth are also more likely to live in disadvantaged neighborhoods which increase their victimization, observation, and fear of violence.

Objectives: This study tested if victimization, observation, and fear of violence in the neighborhood during adolescence predict trajectory of body mass index (BMI) in the 3rd decade of life in African Americans.

Patients and Methods: Data came from an 18-year community-based cohort. We used multi-group latent growth curve modeling for data analysis, considering neighborhood violence at age 15 (i.e. victimization, observation, and fear) as predictors, and the linear slope for the average change in BMI from age 21 to 32 as the outcome, with age and socioeconomic status (i.e. intact family and parental employment) as covariates.

Results: Fear of neighborhood violence at age 15 was predictive of an increase in BMI from age 21 to 32 among female but not male African Americans. Victimization and observation of violence at age 15 did not predict BMI change from age 21 to 32 among female or male African Americans.

Conclusions: Fear of neighborhood violence is a contributing factor to increased risk of obesity for female African American youth who live in disadvantaged areas. This finding has implications for prevention of obesity among African American women who are at highest risk for obesity in the United States. Initiatives that enhance neighborhood safety are critical strategies for obesity prevention among African American women.

Keywords: Violence, African Americans, Obesity, Emerging Adulthood

1. Background

For young people who strive to achieve financial, residential, emotional, and social independence, transition to adulthood is one of the most stressful developmental periods, marked by multiple transitions (1, 2). In addition to the normative developmental stressors that every individual experiences, African Americans are also exposed to several stressors related to social disorder and unsafe neighborhoods that cumulatively deteriorate health and well-being (3). As African Americans tend to live in economically disadvantaged areas, neighborhood-related stress is a main source of daily hassles for them (4, 5). Although exposure to stress in multiple life domains, including those related to the social environment, increases

risk for poor physical and mental health outcomes among African American emerging adults (3), the effects of neighborhood stress on health may be gender specific (4, 5).

African American youth who live in low-income neighborhoods are more likely to witness shootings, stabbings, and killings in their neighborhoods compared to White or middle class peers (6, 7). This is especially true for African American male youth (6, 7). For African Americans who are in transition to adulthood in the inner cities, perceived unsafe environment, neighborhood fear, and exposure to violence are significant daily challenges associated with a wide range of undesired health outcomes (4, 5, 8-15).

A growing body of evidence suggests that exposure to violence may increase risk of obesity and metabolic syndrome (16, 17). This is consistent with the literature

on the relationship between exposure to chronic stress and risk of obesity among adolescents and young adults (18). The mechanisms underlying such a link may include lifestyle changes such as decreased physical activity, increased food intake, depression, as well as altered activity of the hypothalamic-pituitary-adrenal (HPA) axis (18). Gender is also shown as an important factor in the stress-obesity link (18).

Even in the absence of direct exposure to violence (violence victimization), living in unsafe neighborhoods engenders fear and anxiety (19-21). Among residents of economically and socially deprived neighborhoods, perceived neighborhood fear predicts high depressive symptoms (22), low outdoor physical activity, and poor physical health (23, 24), both among adolescents (19) and adults (21). High propensity for crime, disorder, and violence in low-income communities is a direct consequence of structural racism, as well as social inequities, lack of availability of jobs, and blocked opportunities (21, 25).

High rate of violence in the communities affects physical and mental health of African American youth during their transition to adulthood (26, 27). African Americans who cannot afford moving to suburban areas and must continue living in low income urban neighborhoods are at an increased risk of exposure to crime and unsafe conditions associated with the constrained economic opportunities and limited social resources in such context (28). Despite a desire to craft occupational, educational, and relational aspirations for their lives, living in high crime and unsafe neighborhoods increases African American youths' day-to-day exposure to violence or perception of fear which adds to their already high levels of financial stress (27, 29, 30). In such unsafe neighborhoods, survival maintenance becomes a priority for many African American youth (4, 31, 32).

Using a life course epidemiological approach (33, 34) and built on the socio-ecological model of development (35), this longitudinal study followed African American youth who were living in economically disadvantaged and unsafe urban areas for 18 years to test if victimization, observation, and fear of neighborhood violence at age 15 predict the development of obesity during their 3rd decade of life, and if male and female African American youth differ in such a prediction.

2. Objectives

This study tested if victimization, observation, and fear of violence in the neighborhood during adolescence predict trajectory of body mass index (BMI) in the 3rd decade of life in African Americans.

3. Patients and Methods

This study used data of the Flint adolescent study (FAS), 1994 to 2012. The FAS is an 18-year longitudinal study of youth who were transitioning from adolescence to early adulthood (36, 37). The study protocol was approved by the local Institutional Review Board and all participants provided consent or assent before each interview.

Participants were sampled from four local public high schools. The study sampled ninth graders who had a grade point average (GPA) of 3.0 or lower (in eighth-grade). Diagnoses of developmental disability or emotional impairment were exclusion criteria.

For the current analysis we used demographic and socio-economic data collected at age 15 (Wave 1), neighborhood violence at age 15 (victimization, observation, and fear), and BMI at ages 23 to 32 (Waves 5, 8, 9, 11, 12). A total number of 681 African American youths (335 males and 346 females) participated in the current study. The retention rate was 90% from Waves 1 to 4; 75% from Waves 4 to 8.

3.1. Procedure

Data were collected using face-to-face structured interviews conducted either at school or at alternative community locations. Each interview lasted about 60 minutes on average. This study followed participants regardless of students' dropping out of school.

3.2. Measures

3.2.1. Covariates

Demographic data (age and gender) and two measures of family socio-economic status (parental employment and family structure) were measured at baseline (year 1994). Parental employment status was operationalized as a dichotomous variable (both parents employed versus any other conditions). Family structure was also measured as intact (youth living with both biological parents versus any other condition) or others.

3.2.2. Fear of Neighborhood Violence

The following two items were used to measure individual perception of fear from violence in the neighborhood: 1, I am afraid of the violence in my neighborhood; and 2, I worry that someone in my neighborhood will physically hurt me. Both items used a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). We used a mean score with higher score indicative of more fear if violence in the neighborhood ($r = 0.44$, $P < 0.05$), (Appendix 1).

3.2.3. Observation of Violence

Participants were asked for the last 12 months, how often they had 1, seen someone commit a violent crime where a person was hurt; and 2, seen someone get shot, stabbed, or beaten up. Both items used a 5-point Likert scale, ranging from 1 (0 times) to 5 (4+ times). The two items were positively correlated. We used a mean score, where a higher score was indicative of more frequent violence observation ($r = 0.52$, $P < 0.001$), (Appendix 1).

3.2.4. Victimization of Violence

The following three items were used to measure individual exposure to violence: During the last 12 months, how often have you 1, had someone threaten to hurt you; 2, had someone physically assault or hurt you; and 3, had someone take something from you using physical force. All three items used a 5-point Likert scale, ranging from 1 (0 times) to 5 (4+ times). We used a mean score, where higher score was indicative of higher victimization of violence, (Appendix 1).

3.2.5. Body Mass Index (BMI)

The BMI was calculated based on self-reported weights and heights, which were originally collected in pounds (1 pound = 0.453 kilograms) and feet (1 foot = 0.3048 meters)/inches (1 inch = 0.0254 meters), respectively. The BMI calculated based on self-reported weight and height is closely correlated with BMI based on direct measures of height and weight (38).

3.3. Data Analysis

The current study only included African Americans, as only 17% of the original sample was composed of Whites. Univariate and bivariate analysis were done in SPSS 20.0. Bivariate associations were tested using Pearson's correlation test. AMOS 20.0 was used for multivariable analysis (39, 40).

Multi-group latent growth curve modeling (LGCM) -a type of structural equation modeling (SEM) (41) - was used for multivariable data analysis, where groups were defined based on gender. In the first step, we ran unconditional models, which suggested no covariate and no constraints on any paths across the groups. In the next step, we added our predictors of interest and covariates. We implemented full information maximum likelihood (FIML) to account for missing data.

Fit statistics included p more than 0.05, Chi square, the comparative fit index (CFI) [> 0.90], the root mean squared error of approximation (RMSEA) [< 0.06], and X^2 to degrees of freedom ratio (42-44). Standardized regression coefficients and standard errors (SE) were reported.

4. Results

4.1. Univariate Analysis

Table 1 provides descriptive statistics for demographics, violence (fear of neighborhood violence, violence observation, and violence victimization), and BMI in the pooled sample, and based on gender. From Wave 5 to 12, BMI increased gradually among both male and female participants ($P < 0.001$ for trend). Females had higher BMI than males at all waves with the last wave being an exception ($P < 0.001$ for all significant associations). While fear of neighborhood violence, violence observation, and violence victimization at Wave 1 were high for both genders, fear of violence in neighborhood was marginally higher for females, and violence observation was significantly higher for males. Violence victimization at wave 1 did not differ between male and females (Table 1).

4.2. Bivariate Analysis of Violence and Control Variables by Gender

As Table 2 suggests, living in an intact family at baseline was marginally associated with less violence observation and correlated with violence victimization for boys. Intact family at baseline was not associated with any of the violence measures for girls. Number of parents working was negatively associated with violence victimization for boys. Such association could not be found among girls. For boys, violence victimization was negatively associated with the amount of BMI increase from Wave 5 to Wave 12. For girls, violence victimization was positively but marginally associated with BMI increase from Wave 5 to Wave 12.

4.3. Multivariable Model

The fit of our multi-group LGCM was very good [$\chi^2 = 233.991$, $df = 91$, $P < 0.001$, $\chi^2/df = 2.571$, $CFI = 0.936$, $RMSEA = 0.048$, (90% CI = 0.041, 0.056)], (Figures 1 and 2).

As depicted in Table 3, baseline violence observation had a marginal negative association with baseline BMI among females ($\beta = -0.12$, $P = 0.055$) and parent employment was negatively associated with baseline BMI for females ($\beta = -0.20$, $P = 0.003$). Among females, baseline fear of neighborhood violence was associated with the linear slope of the BMI ($\beta = 0.18$, $P = 0.026$), suggesting that the BMI increase in the 3rd decade of life is larger for females who had high levels of fear of neighborhood violence at baseline. This path was not significant for males ($\beta = -0.01$, $P = 0.941$), (Table 3).

Table 1. Descriptive Statistics for Demographic, Socioeconomic, Violence, and Body Mass Index Among Male and Female African Americans

Variables	All			Men			Women		
	n	Range	Mean (SD)	n	Range	Mean (SD)	n	Range	Mean (SD)
Age (Wave 1) ^a	681	13.87 - 16.88	14.86 (0.65)	335	13.87 - 16.85	14.94 (0.66)	346	13.89 - 16.88	14.79 (0.62)
Fear of violence in neighborhood (Wave 1) ^b	678	1.00 - 4.00	2.02 (0.65)	334	1.00 - 4.00	1.98 (0.65)	344	1.00 - 4.00	2.07 (0.64)
Violence observation (Wave 1) ^c	680	1.00 - 5.00	2.28 (1.20)	334	1.00 - 5.00	2.38 (1.25)	346	1.00 - 5.00	2.18 (1.14)
Violence Victimization (Wave 1)	680	1.00 - 4.67	1.44 (0.59)	334	1.00 - 4.67	1.45 (0.59)	346	1.00 - 4.33	1.42 (0.60)
BMI (Wave 5) ^a	448	15.81 - 56.48	26.42 (6.49)	196	15.81 - 56.48	25.50 (5.43)	252	16.72 - 54.85	27.14 (7.13)
BMI (Wave 8) ^d	449	16.72 - 57.60	27.54 (6.62)	207	17.62 - 54.91	26.29 (5.53)	242	16.72 - 57.60	28.61 (7.26)
BMI (Wave 9) ^a	248	16.03 - 68.63	31.20 (9.14)	98	18.24 - 62.73	29.10 (8.21)	150	16.03 - 68.63	32.57 (9.47)
BMI (Wave 10) ^c	296	17.12 - 68.63	31.09 (8.73)	123	17.93 - 61.00	29.40 (7.38)	173	17.12 - 68.63	32.29 (9.42)
BMI (Wave 11) ^d	307	16.17 - 62.73	30.99 (8.24)	134	19.12 - 62.73	29.65 (7.71)	173	16.17 - 57.75	32.03 (8.50)
BMI (Wave 12)	289	17.21 - 61.00	31.12 (8.04)	128	18.46 - 61.00	29.00 (7.24)	161	17.21 - 60.03	32.81 (8.27)

Abbreviation: BMI, body mass index.

^ap < 0.01.

^bp < 0.1.

^cp < 0.05.

^dp < 0.001.

Table 2. Correlations Between Demographic, Socioeconomic, Violence, and Body Mass Index Among Male and Female African Americans^a

Variables	1	2	3	4	5	6	7	8
1 Age (Wave 1)	1	-0.099 ^b	-0.132 ^c	-0.101 ^b	0.074	0.126 ^c	0.066	-0.055
2 Intact Family (Wave 1)	-0.123 ^c	1	0.108 ^b	0.048	-0.105 ^b	-0.140 ^c	0.118 ^b	0.004
3 Number of Parents Working (Wave 1)	-0.162 ^d	0.132 ^c	1	-0.079	-0.021	-0.139 ^c	-0.063	0.160
4 Fear of violence in neighborhood (Wave 1)	-0.072	0.011	0.078	1	-0.138 ^c	-0.070	0.003	0.044
5 Violence Observation (Wave 1)	0.122 ^c	0.062	-0.015	-0.103 ^b	1	0.268 ^d	-0.039	-0.026
6 Violence victimization (Wave 1)	0.106 ^c	-0.049	-0.026	0.025	0.250 ^d	1	.051	-0.206 ^c
7 BMI (Wave 5)	0.041	0.024	-0.157 ^c	0.125 ^c	-0.096	0.004	1	0.271 ^d
8 BMI Change (Wave 5 to 12)	-0.155 ^b	0.006	.078	-0.028	0.132	0.172 ^b	-0.222 ^c	1

Abbreviation: BMI, body mass index

^aMales upper diagonal, females lower diagonal, P < 0.001.

^bp < 0.1

^cp < 0.05.

^dp < 0.01

5. Discussion

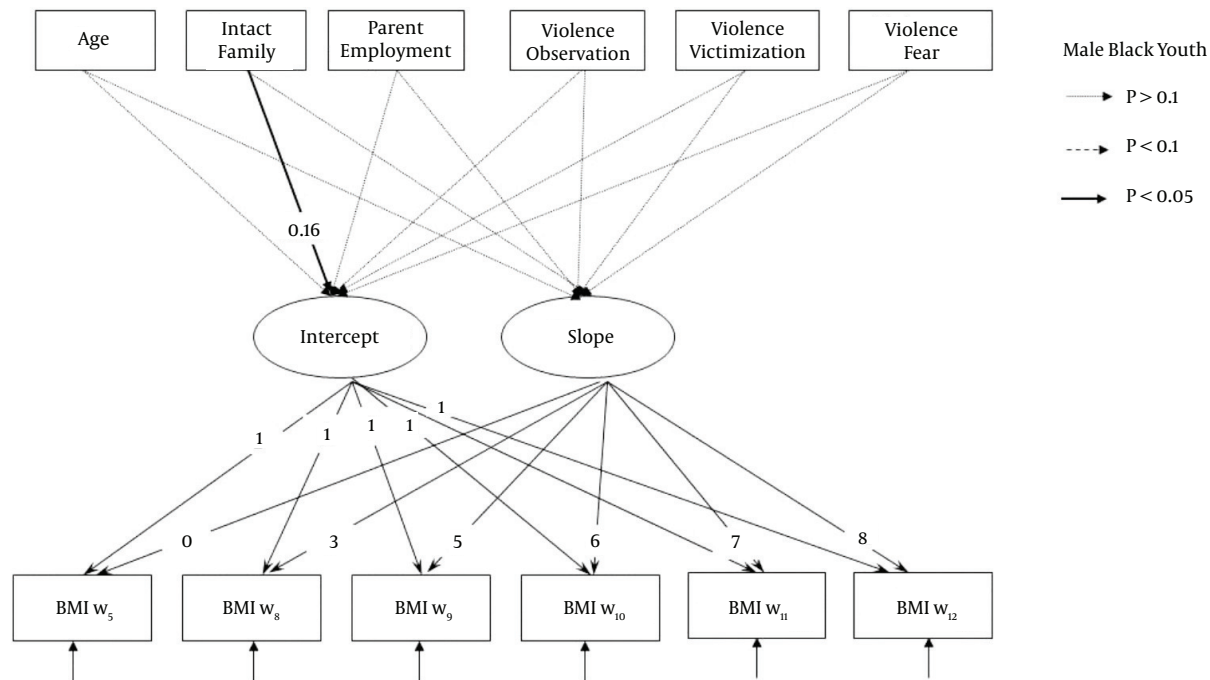
Fear of violence in the neighborhood at age 15 is predictive of an increase in BMI from age 21 to 32 among female but not male African American youth. Thus for female African American youth who live in disadvantaged areas, fear of violence in the neighborhood is one of the contributing factors of their increased risk of obesity.

This study makes a unique contribution to the literature by suggesting a mechanism for higher rates of obesity among African American females who live in unsafe neighborhoods. African Americans are more likely than any other ethnic groups to develop the negative outcomes associated with living in high-risk neighborhoods (45-47). Our study offers insights about potential social and cognitive processes that contribute to the trajectories of obesity

among African American females during the transition to adulthood.

The current study builds on past research by noting that for African American females, it not the exposure to violence per se, but the perceived fear of violence in the neighborhood which has subsequent and lasting effects on obesity 18 years later. Perceived fear of violence may be one of the ingredients by which poor environments change human behavior (24, 31). Perhaps this fear contributes to a lack of engagement in outdoor physical activities during the transition to adulthood that continues over a lifetime, which has implications for future obesity. Our findings are also consistent with other studies indicating that exposure to physical violence is associated with obesity (16, 17). Given the fact that fear is a type of stress (48),

Figure 1. Summary of Latent Growth Curve Modeling Among Male African American Youth



$[\chi^2 = 233.991, df = 91, P < 0.001, \chi^2/df = 2.571, comparative\ fit\ index\ (CFI) = 0.936, root\ mean\ squared\ error\ of\ approximation\ (RMSEA) = 0.048, (90\% \ CI = 0.041, 0.056)].$

our finding is in line with the literature on the effect of psychological stress on obesity (18), with some interactions with gender and economic status (18).

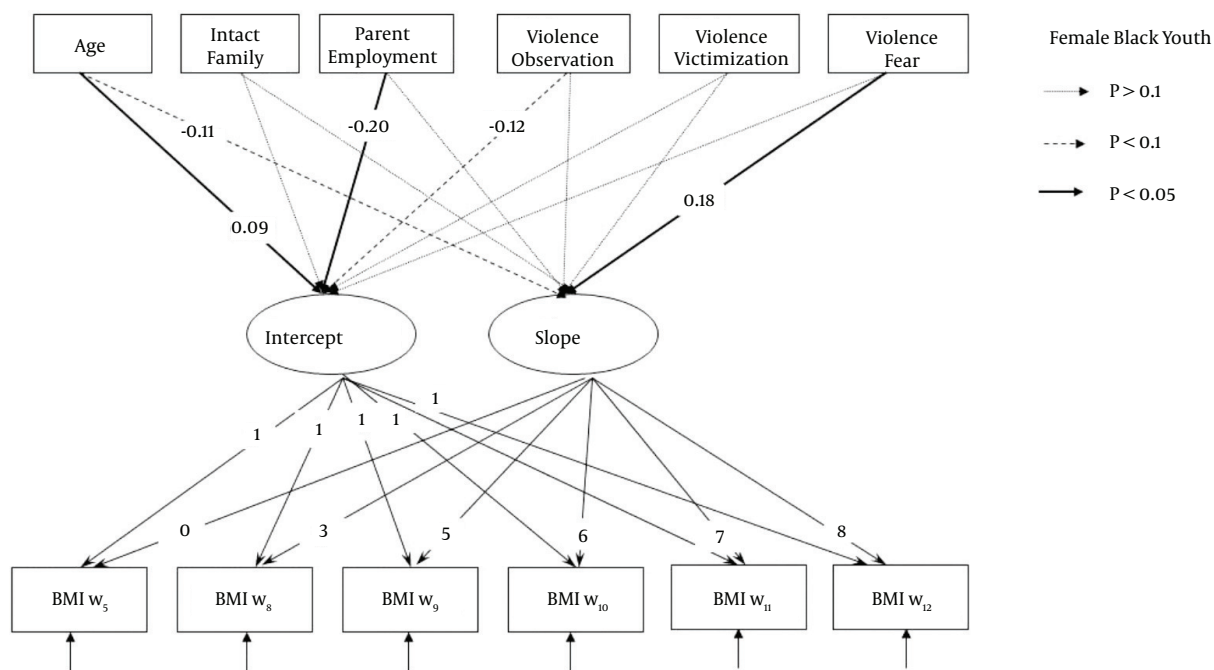
Supporting our findings, it has been previously shown that psychosocial stress plays an important role in development of excess body fat and obesity (49-51). Although the exact mechanism of the effect of stress on obesity is still unknown (51), as suggested by McEwen and Seeman (51) long-term stress has the potential to induce long lasting changes to the stress reaction through physiological pathways that have well-established roles in obesity and metabolic syndrome (52-54). A number of studies have shown that chronic psychosocial stress is a risk factor for obesity, and causes excess body fat accumulation, especially in the abdomen (49-51, 55).

Based on social disorganization theory originally developed by Shaw and McKay in 1942 (56), specific social processes mediate the effect of living in unsafe neighborhoods on health, behaviors, and well-being of individuals and populations. In this view, a neighborhood is a complex system that shapes exposures and resources, including peers and families (26). Our findings confirms and extends this theory by suggesting that perceived neighborhood fear may be one of the mechanisms that may explain

how the social environment may adversely affect individual physiological changes.

Although previous researchers have investigated psychosocial risk factors of obesity, few have tested the role of exposure to violence for African American youth. African American adolescents who reside in disadvantaged neighborhoods are often exposed to high levels of physical violence as victims, witnesses and, to a lesser extent, as perpetrators. Among urban youth, 50% - 100% report witnessing violence in their community (9, 45, 57), with African American boys at higher risk for witnessing violence (4, 45). Youth from lower SES families are also more likely to reside in poorer, urban neighborhoods characterized by higher crime levels among other disadvantages (26, 47). A recent qualitative study by Smith on 40 Black men (aged 18 - 24 years) applied life history calendar tools to provide a comprehensive history of loss and also identified the developmental timing of deaths. On average, participants knew 3 homicide victims who were overwhelmingly peers. Participants had started experiencing homicide death in early childhood, which peaked in adolescence and persisted into emerging adulthood. The researchers concluded that young black men frequently experienced traumatic loss of peers to homicide (32). Although our findings support this

Figure 2. Summary of Latent Growth Curve Modeling Among Female African American Youth



[$\chi^2 = 233.991, df = 91, P < 0.001, \chi^2/df = 2.571, comparative\ fit\ index\ (CFI) = 0.936, root\ mean\ squared\ error\ of\ approximation\ (RMSEA) = 0.048, (90\% CI = 0.041, 0.056)$].

Table 3. Summary of Path Coefficients Among Male and Female African American Youth^a

Variables	Men		Women			
	β (SE)	P	β (SE)	P		
Predictors of intercept						
Age	→	Intercept-BMI	0.07 (0.07)	0.196	0.09 (0.08)	0.035
Intact family	→	Intercept-BMI	0.16 (0.14)	0.026	-0.01 (0.17)	0.904
Parent employment	→	Intercept-BMI	-0.01 (0.10)	0.945	-0.20 (0.10)	0.003
Violence observation	→	Intercept-BMI	-0.04 (0.05)	0.572	-0.12 (0.06)	0.055
Violence victimization	→	Intercept-BMI	0.05 (0.11)	0.542	-0.05 (0.12)	0.410
Fear of violence	→	Intercept-BMI	-0.07 (0.09)	0.300	0.05 (0.11)	0.421
Predictors of slope						
Age	→	Slope-BMI	-0.09 (0.01)	0.242	-0.11 (0.01)	0.058
Intact family	→	Slope-BMI	-0.02 (0.02)	0.823	0.01 (0.02)	0.925
Parent employment	→	Slope-BMI	0.03 (0.01)	0.758	0.09 (0.01)	0.307
Violence observation	→	Slope-BMI	0.02 (0.01)	0.860	0.13 (0.01)	0.124
Violence victimization	→	Slope-BMI	-0.07 (0.02)	0.483	0.03 (0.01)	0.744
Fear of Violence	→	Slope-BMI	-0.01 (0.01)	0.941	0.18 (0.01)	0.026

Abbreviation: BMI, body mass index.
^a β , Standardized path coefficients.

literature, we found that fear of violence operates differently by gender and has more noxious effects for females than males when linked to obesity in young adulthood.

Our findings are important considering the fact that youth, particularly African American youth, witness or become victims of physical assaults, use of weapons, sexual victimization and harassment, property victimization, maltreatment, and other violent acts (58, 59). According to the national survey of children's exposure to violence, in a one year period, 61% of the adolescents are victims or witnesses to physical violence and 7% are threatened or injured with weapons (60). Compared to other racial and ethnic groups, risk of experiencing multiple forms of violence has been shown to be twice as high among African American youth compared to other race/ethnic groups. High level of exposure of African American youth to violence is mostly due to residence in disadvantaged areas with undesired social and economic conditions in the neighborhood (61). It has been shown that among African Americans, living in high-risk neighborhoods is a strong predictor of exposure to violence (62). Gender is known to influence pattern of exposure to violence, as boys are more likely to experience assaults while girls are more likely to be exposed to sexual violence (60).

Our finding that high levels of fear of neighborhood violence at age 15 was associated with a larger increase in BMI in early adulthood among African American females advocates for prevention of violence and related fear in economically disadvantaged areas where African American females may develop obesity due to fear of violence. This is particularly important due to highest rate of obesity among African American women in United States (63).

Policies should reduce violence against all youth in homes, schools, and neighborhoods (59). This is particularly needed for adolescents who reside in disadvantaged neighborhoods and may be exposed to high levels of physical violence as victims, witnesses and, may experience fear of violence. Among urban youth, 50% - 100% witness violence in the neighborhoods (45), with African American youth at highest risk for witnessing violence (4, 45). This risk is highest for African American youth from lower socioeconomic families who reside in poor urban neighborhoods characterized by high crime rates among other social disadvantages (26, 47).

Similar to the results of the current study, gender differences on the health effects of fear of neighborhood and neighborhood safety have been previously shown. In a recent study by Assari et al. in 2015 (4), an increase in fear of neighborhood violence was associated with an increase in depressive symptoms for African American male but not for female young adults who were living in poor urban areas. Based on that study, even incremental increase

in fear of neighborhood violence among African American among 21 - 22 year old males was predictive of an increase increase in depressive symptoms two years later (4). In another study on a racially diverse sample, Assari et al. found that perceived neighborhood safety at age 15 predicted subjective health at age 33; however, as with fear in this study, the effect was found only among females (5).

Our findings suggest that interventions, programs, and policies that increase sense of safety in the communities should be considered as a strategy to prevent obesity during emerging adult African American females. Future research that tests if programs and policies that lower neighborhood crime and violence rate also reduce the burden of obesity among African American females would be useful. Programs that increase availability of psycho-educational resources in the communities where African-Americans live may also help African American females better cope with fear of violence in their high risk neighborhoods. Most importantly, more initiatives are needed to increase safety in urban neighborhoods. Policies that address this issue at the structural level (e.g. more policing, better street lights, no abandon housing, etc.) will enhance sense of safety at the community.

Our study has a few limitations that are necessary to acknowledge. Our sampling strategy was not random, so the results may not be generalizable to all African Americans in the U.S. We used few items to measure fear, observation, and victimization of violence. Future studies that apply more comprehensive measures of violence, fear, and exposure are needed. Our study relied on self-report variables and was limited to individual level characteristics. Examining how neighborhood level violence is associated with subsequent risk of obesity would be a useful direction for future research (64). Finally, our study did not measure medical and behavioral risk factors of obesity including diabetes, exercise, diet, as well as HPA function. Despite these limitations, our longitudinal design and long term follow up both represent significant contributions to the literature.

To conclude, perceived fear of neighborhood violence during adolescence predicts change in BMI in the 3rd decade of life among African American females. Our findings provide further evidence of the connection between stressors associated with violence and obesity, and in this instance a connection between prevention in criminal justice and public health systems. Programs and policies that prevent violence and enhance perceived safety may be useful strategies for obesity prevention among female African American young adults.

Supplements

Supplementary material(s) is available at below link:
http://archtrauma.com/?page=download&file_id=58284

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Footnotes

Authors' Contribution: The original idea of this analysis was developed by Shervin Assari. Shervin Assari also analyzed the data. Maryam Moghani Lankarani drafted and revised the manuscript. Marc A Zimmerman designed the main cohort and acquired the data, and Cleopatra Howard Caldwell and Marc A Zimmerman contributed to all drafts of this manuscript. All authors confirmed the final version of the manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

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